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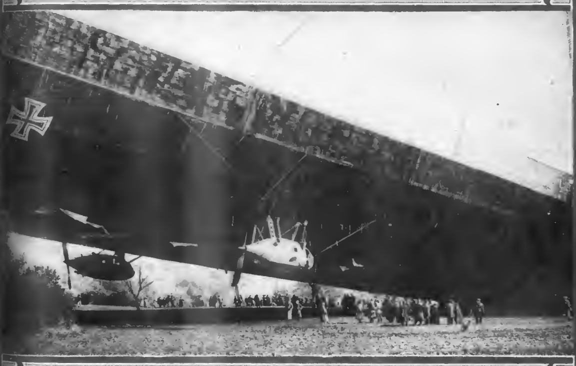

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Number 8

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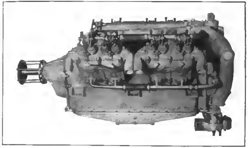

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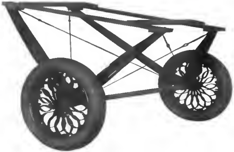

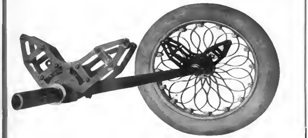

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VOL. III. NO. 8

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Vol. III November 15, 1917 No. 8

Langley's Flying Machine

By Carl H. Butman

Late of the Smithsonian Institution

The Langley "aerodrome," the first man-carrying airplane ever built, is now exhibited by the Smithsonian Institution in the older building of the United States National Museum at Washington, D. C., as a very valuable historical relic.

Samuel Pierpont Langley, the inventor of the flying machine, has been long in coming into his own, but at last his name has come to stand for the pioneer in aviation.

According to Dr. A. F. Zahm, aeronautical expert, United States Navy, "Langley's aerodynamic experiments, some published and some as yet unpublished, were complete enough to form a basis for practical pioneer aviation. He built and launched, in 1896, the first steam model airplane capable of prolonged free flight, and possessing good inherent stability; he built the first internal-combustion engine suitable for a practical man-carrying airplane, he developed and successfully launched the first gasoline model airplane capable of sustained free flight, and he developed and built the first man-carrying airplane capable of sustained free flight."

At the Panama Pacific International Exposition there was erected a great column dedicated to Progress, representing, in that connection, Aviation. It bore the following inscription: "To commemorate science's gift of Aviation to the world through Samuel Pierpont Langley, an American."

To the memory of Langley, late Secretary of the Smithsonian Institution, the civilized world finally bared its head nearly ten years after his death. His man-carrying "aerodrome," built in 1900-03, was flown in 1914, thereby vindicating the claims Langley advanced; first in 1896, when he flew his steam model successfully, and supplemented in 1903, when his gasoline model flew, although his two attempts to launch the large machine in the latter year failed. It has since been established that this machine will fly under its own power as originally designed and built, and even carry additional weight.

SAMUEL PIERPONT LANGLEY
After a Painting by Carl Smith

The original machine, surnamed the "Buzzard," was returned to its birthplace, the Smithsonian, in March, 1904, after the conclusion of the experiments, and there stored for ten years. On April 2, 1914, it was shipped to the Curtiss factory at Hammondsport, N. Y., for reassembling and tests. Dr. Charles D. Walcott, Secretary of the Smithsonian Institution, and Dr. Albert F. Zahm, Recorder of the Langley Aerodynamical Laboratory, and now a Naval aeronautical expert, were present and witnessed the first flight. This experiment was primarily an engine and planing test, although the machine was mounted on pontoons for an over-water flight. Great, therefore, was the surprise of those present when after running over the surface of the water for a short distance, the machine lifted itself into the air and proceeded to fly.

Considerable publicity was given this and later trials by the press, but as many of the newspaper articles were unfortunately vague, and even inaccurate, it was hitherto difficult to ascertain just exactly what had been accomplished. It has been the purpose of the writer, however, to look into the matter very carefully and consult witnesses and authorities. The story in brief follows:

Upon the receipt of the complete flying machine at Hammondsport, it was reassembled. Few changes were made, since it was desired to fly it in its original form if possible. First the engine was put through a shop test, which showed the necessity of replacing the old intake manifold pipe and of adding a new carburetor. It also proved expedient to install a magneto in place of the original batteries used for sparking. There being a spare pair of propellers, they were cut down on the corners much after the fashion of the early Wright-type blades, but as this did not increase the efficiency, Mr. Langley's original fan-type set was used.

The first trials with the floats, which consisted of two shallow draft pontoons forward and a float aft, proved that the machine would plane very well with the original wings. Then followed on May 28, 1914 a demonstration of the complete machine, which well proved the efficiency of the engine. This, the original power plant, not only drove the machine over the water, but lifted it out completely and started on a flight in

NOTE.—The name "aerodrome" was given by the late Samuel Pierpont Langley to the flying machine in 1893 from ἀεροδρομέω (to traverse the air) and ἀεροδρόμος (air runner).

spite of the additional dead weight of the pontoons, a weight never anticipated by the inventor

Dr Walcott, who was fortunate in observing this test, made the following statement to the writer

" Early in the morning of May 28 the machine was launched with its pontoons and Glenn H Curtiss climbed into the aviator's seat Starting the propellers, the machine glided over the water for 200 or 300 yd, bringing the pontoons so that

QUARTER SIZE MODEL OF THE "AERODROME" IN FLIGHT AUG. 8, 1903
Photo Smithsonian Institution

they planed over the surface It then rose in the air a short distance and continued for about 200 ft when Mr Curtiss brought it back to the water

" Several trials were made subsequently, but owing to engine trouble and the giving way of certain of the old ball bearings between the engine and the propellers, the pontoons did not get out of the water

" It was decided to strengthen all bearings so that the strain between the engine and the propellers, resulting from the weight of the pontoons and supports, would be provided for.

" The several trials proved great stability for the tandem type of machine. As the result of experience with biplanes and monoplanes during the past ten years, another tandem machine, if built, would have a very much smaller wing surface and would be provided with an engine of greater power and efficiency "

Soon after the first flight, some readjustments were made on the machine and further tests were conducted on June 2, with

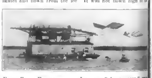
FULL SIZE LANGLEY "AERODROME" READY FOR LAUNCHING, OCT 7, 1903, ON POTOMAC RIVER, NEAR WIDEWATER, VA
Photo Smithsonian Institution

far better results, although no lengthy flights were made, for it was thought best not to over-tax and possibly destroy the engine, bearings and shafting The added weight of the pontoons and their supports increased the weight of the whole machine from 830 lb to 1,170 lb, or 40 per cent, an amount too great for safety and efficiency In the hope of offsetting this additional weight, Dr Walcott agreed that a Curtiss 80 hp. engine with a single-tractor screw be fitted since its line of thrust is practically identical with that of the Langley twin propellers. On installing this power plant, the aviator's seat was moved up and backward between the planes, and other minor adjustments were made

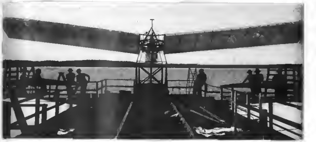
THREE-QUARTERS REAR VIEW OF LARGE MACHINE RESTING ON HOUSE-BOAT TURNTABLE FOR POINTING THE NOSE OF MACHINE INTO THE WIND IS SHOWN BELOW THE PLATFORM
Photo Smithsonian Institution

On Sept 17 two flights were made by Elwood Doherty The complete machine now weighed 1,520 lb, but no bending or warping of the wing frame was noticed in spite of an excess of 83 per cent over the originally designed load.

On Sept 19, after some additional adjustments had been made in balancing, and in the angle of incidence of the wings, and substituting a 9 ft, for an 8½ ft air screw, more successful flights were made between 1,000 and 3,000 ft in length Work on the "America" delayed further tests for awhile, but on Oct. 1, six flights were made, covering distances of from 1,000 to 3,250 ft at a speed of about 35 m p h. Mr Doherty who piloted the machine, stated that the inherent stability was excellent and that the control was satisfactory, although merely the universal tail was used for stabilizing Subsequently longer flights were achieved, and some of these were made when winter having set in, the machine was equipped with skates and flown from the ice It was not flown high in the air, for fear of some accident, since it was felt that it had vindicated itself and deserved to be exhibited as the pioneer American machine



FIRST TRIAL FLIGHT OF THE LANGLEY "AERODROME" FROM HOUSE-BOAT, OCT 7, 1903 IN FALLING, THE FRONT PART OF TRACK CAUGHT THE FRONT GUY-POST AND BENT IT BACKWARD, PULLING THE FRONT OF THE MACHINE DOWN, AS SHOWN THE TWO LOWER GUY-POSTS SHOULD BE PARALLEL
Photo Smithsonian Institution



FRONT VIEW OF LARGE LANGLEY MACHINE ON LAUNCHING WAYS IN 1903
Photo Smithsonian Institution

Langley's "aerodrome," which was completed in 1903, eleven years before it took to the air proved within the limits of its trial flights to be as stable as our modern airplanes. When it is considered that this machine was built at an epoch when the art of metallurgy was not far advanced, one cannot but note with admiration how well the structural steel and the bearing surfaces stood up under tests which far exceeded the requirements for which Mr Langley had allowed

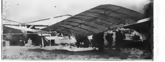
The Langley-type machine is known as a tandem monoplane, its frame in plane view is an elongated ellipse of steel tubing, built, guyed and balanced with the greatest scientific accuracy The four wings, set at dihedral angles for inherent stability,

DR. S P LANGLEY ON RIGHT AND CHARLES M MANLY ON LEFT
Photo Smithsonian Institution

were built up of especially designed hollow ribs of wood, patterned after the quills of a bird, and covered with percaline. Its power was derived from a five cylinder, water-cooled gasoline engine which developed over 50 hp at about 950 r p m., and operated the two propellers from a main shaft by bevel gears The propellers were made of crossed steel tubes covered with cloth The cruciform tail, the sole means of control, was of the Penaud type, arranged for automatic balance, yet sensitive to regulation by the pilot The total wing area was 1,040 sq ft and the weight was 830 lb.—about one-and-one-quarter square feet to the pound—giving a much lower lift loading ratio than is employed today where high speed motors are used. Nevertheless, this ratio enabled Mr Curtiss to fly the machine with about 340 lb. overload.

In 1903 the only apparent fault with the experiments lay in the launching apparatus The method employed comprised a car running on a 60 ft. track, propelled by a catapult arrangement of springs, which with the added thrust of the propellers was calculated to give the "aerodrome" sufficient momentum to start its flight from the top of the house boat.

On the only two occasions when this machine was tested,



VIEW OF THE MACHINE TAKEN AT HAMMONDSPORT IN 1914
Photo Curtiss Aeroplane Co

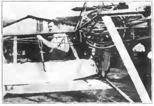
Oct. 7, and Dec 8, 1903, this apparatus unfortunately failed to operate properly and the machine fell into the water. It never had an opportunity to prove its worth On the first trial two clips, which held the forward guy-post of the machine to the launching car, failed to release at the end of the run, and consequently the forward end was dragged downward

Assembling the Langley Machine at Hammondsport
Photo by [illegible]

when the turn part of the track dropped away for clearance This can be seen in the photograph of the first launching, wherein the forward post is seen to be bent backward out of alignment with the after post

Two months later, during the second trial, the bolts holding the rear guy wires gave way, due to too great an initial impulse, allowing the rudder to drag and catch as the machine started to leave the track This pulled the rear of the "aerodrome" down so that the combined forces of thrust and drag made it turn a backward somersault in the water

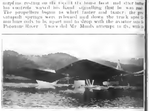
Although Mr Langley considered nearly every form of launching device, including the track, pontoon and catapult methods, he was determined to make safety the greatest factor and therefore launched the machine from the house boat over the water, where, if it should fail, the danger of damage to the aviator and the machine would be as small as possible The system unfortunately did not prove efficient, but it was evolved eleven years ago, and we can all recall the difficulties encountered by the Wright brothers in their early launchings



Glenn H Curtiss Seated in the "Aerodrome"
Photo Dr Charles D Walcott

Had they been discouraged after two attempts nothing would have ever come from their efforts, but being their own masters and not responsible to the Government as Mr Langley was, they were enabled to persist in their efforts until success crowned their work

Charles M Manly, who designed the gasoline engine for the Langley machine and assisted Mr Langley in his research work, also chose to fly the "aerodrome" Despite the fact that the machine lacked a proper landing gear or even shock absorbers of any form, Mr Manly bravely mounted into the airplane resting on the top of the house boat and after testing his controls waved his hand signalling that he was ready The propellers began to whirl faster and faster; the great catapult springs were released and down the track sped the machine only to be upset and to drop with the aviator into the Potomac River Twice did Mr Manly attempt to fly, with the



The "Aerodrome" as Converted into a Seaplane, May 1914
Photo by Charles D Walcott

same results and each time he extricated himself with difficulty from the sinking machine

Mr Langley's interest in aeronautics was manifested first in 1887 when he undertook to demonstrate the possibilities of [illegible] the conditions for transporting in the air a body heavier than air His experiments led from elementary tests with [illegible] airplanes of rubber-band propulsion to tests of single planes and superposed planes, rudders, propellers and other [illegible] [illegible] by the plane-dropper, pendulum, and the whirling table, to steam and gasoline power-plants and model aircraft propelled by them.

Skimming Over the Water Without Wings
Photo Curtiss Aeroplane Co

Success in actual flights first attended his efforts on May 6, 1896, when one of his model steam "aerodromes" made two flights at Quantico, Va. Dr. Alexander Graham Bell, who was present at this first flight of a heavier-than-air machine, said at the time "No one who was present on this interesting

The "Aerodrome" in Full Flight Over Lake Keuka
Photo Bowman

occasion could have failed to recognize that the practicability of mechanical flight had been demonstrated

Other flights of steam models followed upon the first, and on Nov 28 1896, a remarkable flight was witnessed by F G Carpenter, a prominent newspaper man, who reported it to the press. In 1898, President McKinley requested Mr Langley, through the War Department, to build a man-carrying machine, and in spite of Langley's previous statement, "I have brought to a close the portion of the work which seemed to be specially mine, the demonstration of the practicability of

The "Aerodrome" Flies, Sept 17, 1914, with Curtiss Engine and Tractor, Seat Moved Up and Back
Photo Bowman

mechanical flight," he willingly undertook the task which the head of the Nation asked him to shoulder

One more achievement was his before the trials of the large machine and that was the successful flight of the quarter size air-cooled gasoline model which flew unguided and without mishap on Aug 8, 1903

Following the two attempts to launch the man-carrying machine, mentioned above, there came such a flood of ridicule from both the press and the public, that the War Department made no further allotment, but discontinued the trials and turned the machine over to the Smithsonian Institution

It has frequently been said that Mr Langley died of a broken heart, and while this is held by some to be inserted for an added romantic interest, many of the Smithsonian officials and others closely connected with Mr Langley's interests, feel that the unjust criticism of which he became a recipient did much to hasten his end in 1906, three years after his last aeronautical experiments were concluded It is only

The Column of Progress Bearing Langley's Name
Photo Smithsonian Institution

natural that he should have keenly felt the lack of public foresight on the problems which he had mathematically and scientifically proved, but failed to demonstrate practically

Balsa Wood

The United States Forest Products Laboratory has recently conducted a number of tests with Balsa wood to determine its general characteristics.

Some of the results of these tests are now available and are published in the accompanying table

Piece number	Moisture content based on dry weight of wood	Specific gravity based on the air-dry volume	Compression parallel to grain	Hardness
			Maximum crushing strength	Load required to imbed a 0.444 inch ball to one-half its diameter
	Per Cent		Lbs per sq in.	Pounds
1	612.0	104	507	78
2	400.0	122	780	138
Average	506.0	113	643	108
3	3.5	118	1570	75
4	3.7	100	1170	[illegible]
5	4.2	094	930	[illegible]
Average	3.8	104	1220	70

Note.—Specimens 1 and 2 were soaked until saturated throughout, before being tested. Specimens 3, 4, and 5 were tested dry

Airplane Stays

By Harry A. Whitney

From accidents due to the collapsing of a wing, or the wings, of the airplane, it is evident that, in some cases, the wire stays are not equal to the strain put upon them. The reasons for the deterioration of a wire, or strand, suggest improvements, experiments, and tests, which it is hoped may aid airplane constructors in their search for a better stay.

Paradoxical as it may seem, wires of the highest strength are not the best to withstand the sudden strains and constant vibration to which stays are subjected on airplanes. The essential qualities of a durable and reliable stay wire, or stay strand, are strength, combined with toughness and elasticity. In addition, all parts of the stay should be protected from rust. It is important that these qualities should be retained, as far as possible, during the life of the airplane.

Using a 3/16 in solid wire which has a strength of 5000 lb., the finished stay may have a strength of 5100 lb, a loss of 400 lb. In the same way, a wire strand that tests at 4600 lb. makes a stay having a strength of 4100 lb.

Assuming that the turnbuckles employed very properly equal the strength of the stay wire or stay strand used in making the stay, naturally the fastenings of the wire or stay strand are weak points in the completed stay.

At the fastenings, the wire or strand is necessarily subjected to a severe bending stress around the turnbuckle-eye and eye-bolt, which bending not only reduces the strength of the stay wire or strand, but causes the tin or galvanizing to crack and peel from the wires. The wires thus exposed, unless painted frequently, are soon attacked by rust from the moisture which collects on the stays.

A light round thimble, the groove of which conforms to the exact size of the stay strand, should be inserted in the turnbuckle-eye and eye-bolt. This thimble prevents abrasion of the wires and the crushing, or flattening, of the strand at the "pull," or bearing, of the strand in the eye.

Stays should have some rust-resisting coating. Tinning and galvanizing wire is the most common and inexpensive method of preventing rust. Although steel wire loses but 2 per cent of its strength in the process of tinning, tinned wire corrodes.

Galvanized wire resists rust much longer than tinned wire, but galvanizing a steel wire reduces its strength about 8 per cent, and steel wires especially of small sizes do not possess as uniform strength after galvanizing, as can be demonstrated by testing the wires composing galvanized stay strand.

A better stay preservative than either tinning or galvanizing is needed. This suggests a heavy electro-copper or nickel-plate, an elastic weather-proof paint or varnish to be applied to the completed stay, none of which would impair the strength of the stay.

Perhaps this feature has not received proper consideration in selecting wire for stays. As is well-known, Wohler found that "Rupture of metal may be caused by repeated vibrations, none of which attain the absolute breaking limit."

Steel wire ropes used to guy battleship smoke-stacks have broken when under no unusual strain, because the wires had become crystallized and brittle from the constant vibrations to which they had been subjected. Airplane stays, like bicycle spokes, must withstand repeated strains and vibration.

The stresses put upon airplane stays when the machine is brought abruptly to a horizontal position after a long swift earthward glide, are tremendous. Such strains, accompanied by the inevitable stretching of the wires and the usual tightening of the turnbuckles, destroys the elasticity of the wire, while the incessant vibration crystallizes the steel, so that eventually the stays are unable to sustain the load which they carried safely when new.

It would help airplane constructors to decide upon the best qualities and sizes of stay wire and stay strand, if there were available actual strength, elongation, and torsion tests of stay wires and of the wires for stay strands when new, and, for comparison, authentic tests of the wires from stays after they have been in use a definite time. Such tests would probably demonstrate the wisdom of adopting—1, a strong, tough, uniform quality of steel, 2, larger stay wires and strands than commonly used, and, 3, the practice of renewing all wire stays after a certain length of service.

But without the benefit of such tests, practical experience appears to favor a solid wire stay of the best grade of crucible steel rope wire, or bicycle spoke wire, with a slight annealing to toughen the outside surface of the wire. Although not possessing as great strength as the higher carbon plow steel wire, it would withstand bending, sudden strains, and vibration much better.

As to stay strand, the nineteen wires composing the strand should be of the best quality crucible steel rope wire, the strand to be made in two operations, that is, the center wire should be covered by six wires with a short twist. This seven-wire strand should then be covered, by a separate operation, with twelve wires having a longer twist, the object being to have all wires (except the center wire) of the same length, thus distributing the stresses evenly among the wires.

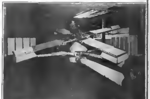
This is not the case when the nineteen wires are twisted into strand in the easiest and cheapest way—that is, in one operation, with the same number of twists in a given length of strand, for the inside six wires wrapped around the center wire are necessarily shorter than the twelve outer wires. Further, the straight center wire should stand greater elongation without breaking than the wires twisted spirally about it.

In conclusion, every manufacturer of airplanes should have rigid specifications and certified tests for all stay wire and wires in stay strands and control-cords, covering strength, elongation, and torsion tests. All wires entering into the strand and control cord should be reasonably uniform, for it is suicidal to use stay strand or cord containing some high strength steel wires low in elongation, while other wires in the strand or cord are of less strength and greater elongation. Uniformity is best secured by testing the ends of every length of wire on a stranding machine when beginning to twist each spool of strand or cord.

The Terra Tutor

In the photograph reproduced herewith is shown an interesting mechanism devised by A. C. Beech, of the Moler Aviation Instructors.

The pupil is seated on a platform which can be tilted laterally or made to pitch fore and aft, or to turn horizontally about a vertical axis. The platform is equipped with a standard Dep control, and carries four arms as seen in the photograph. A 3-foot blower supplies air to a central chamber



under the platform from which air is carried along through pipes to the ends of the four arms. At the ends of these arms are placed air trap gates and rudders.

Just as in the Dep control, the wheel can shut or open the air gates on the side arms and produce or prevent lateral motion. The forward or backward motion of the wheel post produces or prevents pitching in the same manner. The foot bar is connected to a drum which operates the four planes or rudders, one at the end of each arm, and produces or prevents turning.

Airplane Fittings

By J. V. Costello

The term "fittings" as used in this article will apply to any of the metal pieces designed for the purpose of securing together parts of airplanes, such as struts, beams, wires, etc. The fittings used on some of the early type of foreign built machines, recently exhibited in this country, were made

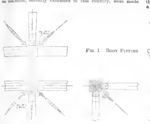


FIG. 1 BODY FITTING

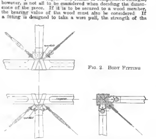


FIG. 2 BODY FITTING

a large part of aluminum castings. This material, while having the advantage of lightness, is not being used by American manufacturers who are producing machines in quantities.

The greater percentage of airplane fittings is easily designed for stampings, and in some instances where great strength is required simple forgings are used, as designs of this character are desirable for rapid production, and being more reliable than castings, the reason for their adoption is obvious.

The grade of material used in stamped fittings varies among different manufacturers. Excellent results are obtained from

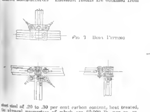


FIG. 3 BODY FITTING

sheet steel of .20 to .30 per cent carbon content, heat treated, the physical properties of which are 60,000 lb per sq in ultimate strength, yield point 40,000 lb. per sq in, and 15 per cent elongation in 2 in. A steel averaging between 10 and .15 per cent carbon is used to some extent by manufacturers. Steel of this grade can be used as received from the mill, being softer, can be bent without fracture, and is not given a subsequent heat treatment. However, the tensile strength is lower, averaging 35,000 to 40,000 lb per sq in, which requires that the design be made correspondingly heavier than the higher carbon steel.

Fittings should be designed to have minimum of material for the required strength. The tensile or compressive strength, however, is not all to be considered when deciding the dimensions of the piece. If it is to be secured to a wood member, the bearing value of the wood must also be considered. If a fitting is designed to take a wire pull, the strength of the ear to which the wire is attached should exceed that of the wire or turnbuckle, as in the event of breakage replacement of a wire is more simple than replacement of a fitting. Sharp

FIG. 4. CONTROL BRACES

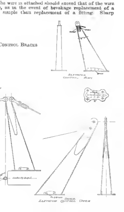


Fig 5 Aileron Hinge

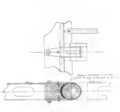


Fig 7 Aileron Hinge

Fig 6 Aileron Hinge

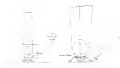


Fig 8 Ball and Socket Fitting

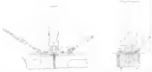


Fig 9 Inter-Strut Fitting

corners should be avoided in bending fittings, and the designer should indicate a radius in corners equal to at least the thickness of the metal itself.

In Fig. 1, the fitting is made up of three pieces, the two sockets for the struts being spot welded and brazed to the main fitting Fig. 2 shows a fitting in which the strut sockets and main fitting are made from a single piece with the wire pulls welded to the main fitting The fitting in Fig 3 is not as simple in design as those illustrated in Figs 1 and 2, and an attempt has been made to allow for varying thickness of the longeron This, to some extent, is also a feature of the others.

The control braces shown in Fig 4 are made of 1/32 in. cold rolled steel. The flat pattern of the base is shown at A The ears are bent up as indicated, and are slipped into and brazed to the brace. There is a variety of designs of the upper end of the brace, some of which are shown in the diagram.

In designing these braces the point of attachment of the control wire is on a line passing through the center of the hinge, normal to the center line of the aerofoil, as shown in the illustration This layout gives the least amount of slack in operating the controls

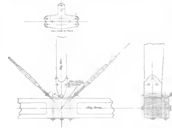


Fig. 10. Inter-Strut Fitting

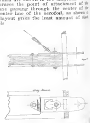


Fig 11 Wing Hinge

Figs 5, 6 and 7 indicate several designs of aileron hinges. The fitting shown in Fig 5 is made up of stampings, and while not as simple as the forgings shown in Fig. 6, it appears more secure in that more advantage is taken of the bearing value of the bolts in the wood.

The hinge shown in Fig 6 is assembled into a slot in the wing beam and the bolt hole is then drilled It frequently happens that in lining up the several hinges along a slightly crooked beam the hinge tongue is not inserted to its proper depth The distance from the center of the bolt to the end of the tongue is made to allow for this variation

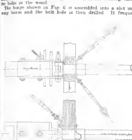


Fig 12 Wing Hinge

Examples of some interplane strut fittings are shown in Figs. 8, 9 and 10 The fitting shown in Fig 8 is of ball and socket type and designed to take care of any ordinary dihedral or wing stagger The plate is designed for the usual wire pulls, the ball is made of cold rolled steel, the stem which projects through the plate is riveted over The ball socket which is brazed into the strut socket is made from deep drawing steel

The wing plate of Fig. 9 is forged. The ears to which the strut is secured are machined at the proper angle to suit the dihedral angle of the wings. This design permits of several different degrees of wing stagger.

The fitting illustrated in Fig. 10 is designed to overcome the comparatively great wind resistance offered by the two types previously shown. It allows for any wing dihedral and the stagger is allowed for in part X. A point to be noted in connection with this design is the use to which the bolt heads have been put in preventing the wire pulls from being bent out of their position

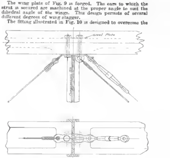


Fig 13 Wing Drag Braces

Fittings designed to secure the wings to the body are usually made up as a hinge This design allows flexibility and is quickly assembled This is one of the most important fittings on the machine. Plate X in Fig 11 has considerable bearing surface against the end of the beam, and takes the compression shocks due to landing The hinge is secured to the beam by two bolts and the method of shouldering the end of the fitting in the routing of the beam is worthy of note

The male portion of the hinge shown in Fig 12 is welded and brazed into a steel tube which extends across the body, and makes an excellent construction

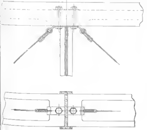


Fig 14. Wing Drag Braces

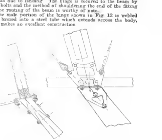


Fig 15 Landing Gear to Body Fitting

The usual wing drag bracing is shown in Figs 13 and 14. The plate fitting of Fig. 13 is a simple stamping, having a bushing spun into the end, which takes the wire terminal, giving more bearing to the wire loop. Thus, however, allows distortion of the wire loop, which has been overcome in the design shown in Fig. 14. This is made from a single piece of sheet steel, doubled. The point at which the fold is made is looped out, and fills the eye of the wire terminal.

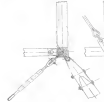


Fig. 16 Landing Gear to Body Fitting

The strut socket fitting shown in Fig 15 is made up from 1/32 in. sheet steel welded to the flange plate, which is solid, giving full bearing area to the end of the strut. The socket is bolted to the simple body fitting with four nickel steel bolts.

The strut socket illustrated by Fig 16 is of the pin variety, is quickly assembled, and gives good streamlining. It will be noted in the drawing that the center lines of the various members meet at a common point, which is a desirable feature.

Considerable difference of opinion exists in regard to the merits of welded fittings and those that are brazed Without question, some fittings, owing to their shape, lend themselves better to the practice of welding than brazing, and vice versa. Take for instance, tubing Where several pieces of tubing are put together a neater job and an easier one is obtained if the parts are torch welded.

In the case of flat surfaces of several square inches area, brazing is advantageous in that the brazing metal can be flowed over the whole area of the joint, whereas the torch can weld only around the edge Of course, the spot welder may be utilized here, provided the thickness of the sheet and general dimensions of the piece permits this operation.

A serious objection to the practice of brazing is that the temperature to which the metal is raised changes the structure of the steel used for fittings

In attempts to heat-treat fittings which have been brazed, even with brazing metals of comparatively high melting points, sufficient success has not been met with to warrant the adoption of this practice The brazing metal of so called high melting point melts at temperatures between 1,600 and 1,700 deg, and the heat required in heat treating, ranging as it does from 1,550 to 1,650 deg, depending on the steel, causes the brazing metal to flow more or less, leaving small openings in the seams, which have to be refilled

In connection with brazing, the use of borax as a flux results in a fitting with a surface of melted borax, which is removed with difficulty Substitution of boracic acid as a flux overcomes this difficulty, as boracic acid is easily removed by washing the parts in water

Welded parts always require a subsequent heat treatment if the full strength of the material is to be obtained.

Fittings on which the welds are apparently sound will sometimes reveal, when broken, that the welding metal has not properly fused. It is this unreliability which has influenced some engineers against the torch welded fitting Imperfect welds are traceable to unskilled or careless workmen.

The practices of brazing and that of welding give excellent results in their proper places, but the homogeneity of welding, permitting as it does proper heat treating, appears to offer the better results

The Lawson Training Airplane

The primary training airplane of the Lawson Aircraft Corporation of Green Bay, Wis, is a tractor two-seater biplane and is built to the United States Army specifications, No 1,000.

The principal characteristics claimed for this machine are the following:

Span.—Upper ... 44 ft.
Lower ... 32 ft
Chord.—Upper ... 7 ft
Lower ... 6 ft
Gap ... 6 ft
Overall length ... 25 ft
Wing curve ... U S A. 5
Power plant one 4-cyl, 100 hp engine (Hall-Scott model A-7a).
Speed.—High ... 67 m.p.h.
Low ... 37 m.p.h
Climb ... 2600 ft. in 10 min.
Weight, light ... 1250 lb.
Useful load ... 550 lb.

International Aircraft Standards

(Continued from last issue)

3N6—Specifications for Soft Brass Sheet

General.—1 The general specification 1G1 shall form, according to their applicability, a part of these specifications

Material.—2 (a) The brass shall have the following chemical composition

	Per cent.
Copper	70 to 85
Lead, maximum	0 15
Iron, maximum	0 06
Zinc	Remainder

(b) Drillings or clippings for analysis shall be taken from both ends of the coil sampled and shall be free from all surface oxide or dirt

Manufacture—3 (a) The brass used shall be crucible melted from lake or electrolytic copper according to I A S B specification 2N2, and spelter B or C grade according to I A. S B specification 2N3.

(b) No scrap shall be used except such as may accumulate in the manufacturer's plants from material of the same composition and of their own make.

(c) All sheet must be fully annealed after rolling

Workmanship and Finish—4 The surface of the brass shall be clean and smooth and it shall be free from injurious defects such as blisters, slivers or dirt embedded in the surface.

Physical Properties and Tests—5 (a) Specimens taken from any lot shall have a minimum tensile strength of 40,000 lb. per square inch (28.12 kg per mm.)

(b) A specimen similar to test sample must withstand being bent double in any direction and hammered flat, so that a gage set at twice the thickness of the metal will pass freely over the bend.

Selection of Test Specimen—6. When shipments are made in coils a specimen from every tenth coil shall be taken for physical tests When shipments are made in short lengths a specimen will be taken from each case.

Dimensions and Tolerances—7 The tolerances allowed shall be as given in the following table

TOLERANCES

English Units.

American Wire Gage (B. & S.)	Thickness inches	Tolerance, inches. Less than 5 inches wide	5 to 8 inches wide	8 to 11 inches wide	11 to 14 inches wide
No. 4 to 14	0 1285 to 0 0641	±0 0029	±0 0033	±0 0036	±0 0040
No. 15 to 18	0571 to 0403	± 0025	± 0029	± 0033	± 0037
No. 19 to 24	0359 to 0201	± 0020	± 0024	± 0028	± 0032
No. 25 to 28	0179 to 0126	± 0018	± 0020	± 0024	± 0028
No. 29 to 32	0113 to 0080	± 0013	± 0017	± 0020	± 0024

Metric Units

American Wire Gage (B. & S.)	Thickness, millimeters.	Tolerance, millimeters. Less than 127 mm. wide	127 to 203 mm. wide	203 to 279 mm. wide	279 to 356 mm. wide
No. 4 to 14	3 264 to 1 628	±0 074	±0 084	±0 091	±0 102
No. 15 to 18	1 450 to 1 024	± 064	± 074	± 084	± 094
No. 19 to 24	912 to 511	± 051	± 061	± 071	± 081
No. 25 to 28	455 to 321	± 041	± 061	± 061	± 071
No. 29 to 32	286 to 202	± 033	± 043	± 051	± 061

Delivery Packing and Shipping—8 (a) When orders call for 12 ft (3.66-m.) lengths, the following tolerances as to lengths will be allowed but in no case shall the aggregate amount of these short lengths exceed 40 per cent

40 per cent may be 10 feet (3.05 meters) or over
30 per cent may be 8 feet (2.44 meters) to 10 feet (3.05 meters)
20 per cent may be 6 feet (1.83 meters) to 8 feet (2 44 meters)
10 per cent may be 4 feet (1.22 meters) to 6 feet (1.83 meters)

When orders call for 10-ft (3 05-m.) lengths the following tolerances as to lengths will be allowed, but in no case shall the aggregate amount of these short lengths exceed 40 per cent

40 per cent may be 8 feet (2.44 meters) or over
30 per cent may be 6 feet (1.83 meters) to 8 feet (2.44 meters)
20 per cent may be 4 feet (1.22 meters) to 6 feet (1.83 meters)
10 per cent may be 2 feet (0.61 meter) to 4 feet (1 22 meters)

When orders call for 8-ft. (2.44-m.) lengths, the following tolerances as to lengths will be allowed, but in no case shall the aggregate amount of these short lengths exceed 30 per cent

30 per cent may be 6 feet (1.83 meters) or over
20 per cent may be 4 feet (1 22 meters) to 6 feet (1.83 meters)
10 per cent may be 2 feet (0.61 meter) to 4 feet (1 22 meters)

When orders call for 6-ft. (1 83-m.) lengths, the following tolerances as to lengths will be allowed, but in no case shall the aggregate amount of these short lengths exceed 20 per cent.

20 per cent may be 4 feet (1 22 meters) or over
10 per cent may be 2 feet (0 61 meter) to 4 feet (1.22 meters)

(b) Coils shall not contain more than four lengths and lengths shall be at least 10 ft (3 05 m) long

3N8—Specifications for Sheet Copper

General.—1. The general specifications 1G1, shall form, according to their applicability a part of these specifications

Material.—2. (a) The copper used shall be lake or electrolytic conforming with the I A. S B specifications 2N2 and shall be hot rolled or hot rolled and finished by cold rolling and annealing or by final cold rolling as required.

(b) Chemical analysis shall not be required but samples may be taken for analysis to check the quality of the material used, in which case the sheet after being thoroughly cleaned from all oxide and dirt, must show a purity of 99 85 per cent copper plus silver

Workmanship and Finish—3. The material shall be clean smooth, of uniform color, and shall be free from all injurious defects

Physical Properties and Tests.—4. (a) The sheets shall have the following physical properties

TENSILE TESTS

Grade.	Minimum tensile strength.	Minimum elongation in 6 inches (50.8 mm.).
Soft	30,000 pounds per square inch (21 09 kg /mm.²)	25 per cent.
Hard	35,000 pounds per square inch (24.61 kg /mm.²)	18 per cent.

(b) Sheets less than 0.072 in. (1.83 mm.) thick are not subject to physical test

(c) The tensile strength of hard-rolled thin sheets will be considerably more and the elongation considerably less than that indicated in the above table

Bend Test—(d) The soft sheets must withstand bending flat on themselves in any direction without cracking.

Selection of Test Specimens—5. One test shall be taken from each lot of 500 lb. (226 8 kg.) or less

Dimensions and Tolerances.—6. (a) The weight or thickness shall not vary more than 5 per cent from that specified. Thickness shall be specified in decimals of an inch or millimeter and shall correspond to the ordinary gage numbers.

(b) For wide sheets or plates above 48 in (1.219 mm.), to and including 60 in. (1,524 mm), a tolerance of 5 per cent over or 7 per cent under gage or weight will be allowed.

(c) For extra wide sheets or plates above 60 in. (1.524 mm.) in width the tolerance may be 5 per cent over or 8 per cent under gage or weight

(d) For the purpose of calculating weights, etc., the specific gravity of copper shall be taken as 8.89 at 20 deg C, or 0.3212 lb per cu in (8 89 g per cm ³).

Delivery, Packing, and Shipping—7 (a) When orders call for 12-ft. (3.66-m.) lengths, the following tolerances as to lengths will be allowed but in no case shall the aggregate amount of these short lengths exceed 40 per cent.

40 per cent may be 10 feet (3 05 meters) or over
30 per cent may be 8 feet (2.44 meters) to 10 feet (3.05 meters)
20 per cent may be 6 feet (1 83 meters) to 8 feet (2.44 meters).
10 per cent may be 4 feet (1 22 meters) to 6 feet (1.83 meters)

When orders call for 10-ft (3 05-m.) lengths, the following tolerances as to lengths will be allowed, but in no case shall the aggregate amount of these short lengths exceed 40 per cent

40 per cent may be 8 feet (2 44 meters) or over
30 per cent may be 6 feet (1 83 meters) to 8 feet (2.44 meters)
20 per cent may be 4 feet (1.22 meters) to 6 feet (1.83 meters)
10 per cent may be 2 feet (0.61 meter) to 4 feet (1 22 meters)

When orders call for 8-ft. (2.44 m.) lengths, the following tolerances as to lengths will be allowed, but in no case shall the aggregate amount of these short lengths exceed 30 per cent

30 per cent may be 6 feet (1.83 meters) or over
20 per cent may be 4 feet (1.22 meters) to 6 feet (1.83 meters)
10 per cent may be 2 feet (0.61 meter) to 4 feet (1.22 meters)

When orders call for 6-ft. (1 83-m. lengths the following tolerances as to

lengths will be allowed, but in no case shall the aggregate amount of these short lengths exceed 20 per cent

20 per cent may be 4 feet (1.22 meters) or over.
10 per cent may be 2 feet (0.61 meter) to 4 feet (1.22 meters)

(b) Below 1 in. (25.4 mm.) wide sheet copper may be furnished in rolls or coils in which case it will be cold rolled or cold rolled and annealed.

3N9—Specification for Phosphor-Bronze Strip

GENERAL.—1. The general specifications 1G1, shall form according to their applicability a part of these specifications

USE.—2 This strip to be used for springs.

MATERIAL.—3 (a) The bronze shall conform to the following chemical composition

	Per cent
Copper	91 to 93
Zinc maximum	0.20
Iron maximum	0.10
Phosphorus maximum	0.15
Tin	Remainder

(b) Drillings or clippings for analysis shall be taken from both ends of the coil sampled and shall be free from all surface oxide or dirt.

MANUFACTURE.—4 (a) The bronze shall be crucible melted from lake or electrolytic copper according to I A S B specification 2N2 and best Straits' or equal tin and deoxidized with phosphorus

(b) No scrap shall be used except such as may accumulate at the manufacturer's plants from material of the same composition and of their own make

(c) All strip shall be rolled to spring temper unless otherwise ordered

WORKMANSHIP AND FINISH.—5 The surface of the strip shall be clean and smooth and it shall be free from injurious defects such as blisters, slivers, or dirt embedded in the surface

PHYSICAL PROPERTIES AND TESTS.—6 Phosphor-bronze spring strip shall have the following physical properties:

	Tensile Strength	Yield Point	Elongation in 2 inches (50.8 mm.)
Minimum	85,000 pounds per square inch (58.78 kg./mm²)	65,000 pounds per square inch (45.70 kg./mm²)	5 per cent
Maximum	118,000 pounds per square inch (86.85 kg./mm²)	85,000 pounds per square inch (59.79 kg./mm²)	20 per cent

SELECTION OF TEST SPECIMENS.—7 When shipments are made in coils a specimen from every tenth coil shall be taken for physical tests When shipments are made in short lengths, a specimen will be taken from each case

DIMENSIONS AND TOLERANCES.—8 The tolerances allowed shall be as given in the following table

TOLERANCES.
ENGLISH UNITS.

American Wire Gage (B & S)	Thickness inches	Tolerance, inches: Less than 5 inches wide	5 to 8 inches wide	8 to 11 inches wide	11 to 14 inches wide
No. 8 to 14	0.1285 to 0.0641	±0.0029	±0.0033	±0.0036	±0.0040
No. 15 to 18	.0571 to .0403	± .0025	± .0029	± .0033	± .0037
No. 19 to 24	.0359 to .0201	± .0020	± .0024	± .0028	± .0032
No. 25 to 28	.0179 to .0126	± .0015	± .0020	± .0024	± .0028
No. 29 to 32	.0113 to .0080	± .0013	± .0017	± .0020	± .0024

METRIC UNITS

American Wire Gage (B & S)	Thickness millimeters	Tolerance millimeters: Less than 127 mm. wide	127 to 203 mm. wide	203 to 279 mm. wide	279 to 356 mm. wide
No. 8 to 14	3.264 to 1.628	±0.074	±0.084	±0.091	±0.102
No. 15 to 18	1.450 to 1.024	± .064	± .074	± .084	± .094
No. 19 to 24	.912 to .511	± .051	± .061	± .071	± .081
No. 25 to 28	.455 to .321	± .041	± .051	± .061	± .071
No. 29 to 32	.286 to .202	± .033	± .043	± .051	± .061

DELIVERY, PACKING, AND SHIPPING.—9 (a) When orders call for 12-ft. (3.66-m.) lengths the following tolerances as to lengths will be allowed, but in no case shall the aggregate amount of these short lengths exceed 40 per cent

40 per cent may be 10 feet (3.05 meters) or over
30 per cent may be 8 feet (2.44 meters) to 10 feet (3.05 meters)
20 per cent may be 6 feet (1.83 meters) to 8 feet (2.44 meters)
10 per cent may be 4 feet (1.22 meters) to 6 feet (1.83 meters)

When orders call for 10-ft (3.05-m.) lengths the following tolerances as to lengths will be allowed but in no case shall the aggregate amount of these short lengths exceed 40 per cent

40 per cent may be 8 feet (2.44 meters) or over
30 per cent may be 6 feet (1.83 meters) to 8 feet (2.44 meters)
20 per cent may be 4 feet (1.22 meters) to 6 feet (1.83 meters)
10 per cent may be 2 feet (0.61 meters) to 4 feet (1.22 meters)

When orders call for 8-ft. (2.44 m.) lengths, the following tolerances as to lengths will be allowed but in no case shall the aggregate amount of these short lengths exceed 30 per cent

30 per cent may be 6 feet (1.83 meters) or over
20 per cent may be 4 feet (1.22 meters) to 6 feet (1.83 meters)
10 per cent may be 2 feet (0.61 meter) to 4 feet (1.22 meters)

When orders call for 6-ft (1.83 m.) lengths the following tolerances as to lengths will be allowed but in no case shall the aggregate amount of these short lengths exceed 20 per cent

20 per cent may be 4 feet (1.22 meters) or over
10 per cent may be 2 feet (0.61 meter) to 4 feet (1.22 meters)

(b) Coils shall not contain more than four lengths and lengths shall be at least 10 ft (3.05 m.) long

3S13—Specifications for 19 Nonflexible Steel-Wire Cable

GENERAL.—1 (a) This specification covers the finish material and construction of high strength steel wire cable composed of steel wires twisted concentrically about a steel wire as center

(b) The general specifications 1G1 shall form according to their applicability a part of these specifications.

MATERIAL.—2. The wire shall be manufactured of either I A S B standard steel No 1065, No 1070 or No 1080 the compositions of which are listed below

MANUFACTURE.—3 (a) The steel wires composing the cable shall be laid around the center wire in one or two layers as required by the number of wires in the cable with a left-hand (counter-clockwise) pitch and with a length of lay not to exceed 11 times the diameter of the cable or not less than 9 times the diameter of the cable

(b) The steel from which the wires composing the cable are drawn shall be manufactured by the acid open hearth process

(c) Wires composing the cable shall be uniformly coated with pure tin to solder readily

(d) Joints in wires composing the cable shall be brazed in a gas fire Tucked in welded or twisted joints will not be permitted No two brazed joints in individual wires shall be closer to one another in the completed cable than 150 feet (45.72 m.) All brazed joints in wires shall be tinned Exposed brass at joints shall not constitute cause for rejection

WORKMANSHIP AND FINISH.—4 Each length of cable is to be evenly laid and free from kinks loose wires, or other irregularities The cable shall remain in this condition when unwound from the reel or bent around a standard thimble proper precautions being taken to secure the ends

PHYSICAL PROPERTIES AND TESTS.—*Tensile Test*—5 (a) A tensile test shall be made upon each reel of cable purchased of a size

(b) Samples of cable for testing tensile strength shall be not less than 24 in. (610 mm.) in length In making tensile tests the distance between jaws of testing machine with sample in place and before test shall be not less than 10 in (254 mm.)

(c) Samples for tensile test may be clamped in the jaws of the testing machine in the usual manner to facilitate testing but in case of failure or dispute on individual tests and at the request of the manufacturer check tests shall be made by socketing the samples with pure zinc.

(d) Cable for use in the construction of aircraft shall meet the required breaking strength specified in the table

Bend Test—(e) One bend test is to be made on a sample cut from each reel of cable of a given size Each sample must be bent once around its own diameter and straightened again at least 20 times in succession in the same direction of bending without any of the wires breaking.

Torsion Test—(f) A torsion test is to be made on one wire from each sample of cable taken for tensile test The wire is to be gripped by two vises 8 in. (203 mm.) apart One vise shall be turned uniformly at as high a rate of speed as possible without perceptibly heating the wire The vise shall have free axial movement in either direction

(g) The number of complete turns which the wire shall stand is determined by the formula

$$\text{Number of turns} = \frac{2.2}{\text{diameter in inches}} = \frac{55.9}{\text{diameter in millimeters}}$$

(h) Failure of one piece of wire to stand full number of turns specified in the above torsion test shall not be considered cause for rejection, but in such case two additional tests shall be made on two more wires from the same sample of cable and if both samples meet the requirements of the specification the cable shall be accepted in this respect

DIMENSIONS AND TOLERANCES.—6 There shall be no permissible variation in size below size Cable having a diameter of 0.031 ($\frac{1}{32}$) to 0.156 ($\frac{5}{32}$) inch (0.79 to 3.96 mm.) inclusive shall have a permissible variation of 10 per cent above size. Cable having a diameter of 0.187 ($\frac{3}{16}$) to 0.375 ($\frac{3}{8}$) inch (4.76 to 9.53 mm.) inclusive, shall have a permissible variation of 7 per cent above size

DELIVERY, PACKING AND SHIPPING.—7 (a) All cable shall be shipped on reels in lengths and sizes as specified on orders.

(b) The dimensions of reels for different lengths and sizes of cable shall conform to the table attached to this specification.

(c) A tinned or galvanized steel seal wire of approved design shall pass around no less than three convolutions of the cable on the reel and shall pass through a linen tag showing the name of the manufacturer the size and length of cable on the reel, the order number or other distinguishing marks and a record of the test for tensile strength A lead seal impressed with the official stamp of the representative of the Government making the inspection shall secure the ends of this seal wire and furnish evidence of inspection and acceptance.

(d) The outer layers of cable on a reel ready for shipment shall be protected from mechanical injury in handling and transportation by an efficient covering of burlap

CHEMICAL COMPOSITIONS OF STANDARD CARBON STEELS

I. A. S. B. No.	Carbon	Manganese	Phosphorus, maximum	Sulphur, maximum
1065	0.60–0.70	0.50–0.70	0.040	0.045
1070	.65–.75	.50–.70	.040	.045
1080	.75–.90	.25–.50	.040	.045

TABLE OF WEIGHTS, SIZES AND STRENGTH OF CABLE

English Units: Diameter inches	Breaking strength pounds	Approximate weight pounds per 100 feet	Metric Units: Diameter millimeters	Breaking strength kilograms	Approximate weight kilograms per 100 meters
0.312 ($\frac{5}{16}$)	12,500	20.65	7.938	5,670	30.73
.250 ($\frac{1}{4}$)	8,000	13.50	6.350	3,629	20.09
.219 ($\frac{7}{32}$)	6,100	10.00	5.556	2,767	14.88
.188 ($\frac{3}{16}$)	4,600	7.70	4.763	2,087	11.46
.156 ($\frac{5}{32}$)	3,200	5.50	3.969	1,451	8.18
.125 ($\frac{1}{8}$)	2,100	3.50	3.175	953	5.21
.109 ($\frac{7}{64}$)	1,600	2.60	2.778	726	3.87
.094 ($\frac{3}{32}$)	1,100	1.75	2.381	498.8	2.60
.078 ($\frac{5}{64}$)	780	1.21	1.984	353.8	1.80
.062 ($\frac{1}{16}$)	500	.78	1.588	226.8	1.16
.031 ($\frac{1}{32}$)	185	.30	.794	83.9	.45

19 wire

METRIC UNITS.

	305 meters				914 meters				1,524 meters				3,048 meters			
mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
0.794	305	102	203	28.58	305	102	203	28.58	305	102	203	28.58	406	102	254	28.58
1.588	305	102	203	28.58	305	102	203	28.58	406	102	254	28.58	406	178	305	28.58
1.984	305	102	203	28.58	406	102	254	28.58	406	178	305	28.58	406	254	203	28.58
2.381	305	102	203	28.58	406	102	254	28.58	406	178	305	28.58	406	254	203	28.58
2.778	406	102	254	28.58	406	178	305	28.58	406	254	203	28.58	457	254	203	28.58
3.175	406	102	254	28.58	406	178	305	28.58	406	254	203	28.58	610	254	254	28.58
3.572	406	178	305	28.58	406	254	203	28.58	610	254	254	28.58	610	406	254	53.98
3.969	406	178	305	28.58	406	254	203	28.58	610	254	254	28.58	610	406	254	53.98
4.763	457	178	305	53.98	457	254	203	53.98	610	254	254	53.98	610	406	254	53.98
5.556	457	178	305	53.98	457	254	203	53.98	610	254	254	53.98	813	406	406	79.38
6.350	457	254	254	53.98	610	254	254	53.98	813	457	406	53.98	914	560	457	79.38
7.938	457	254	254	53.98	610	254	254	53.98	813	457	406	53.98	914	560	457	79.38
8.731	457	254	203	53.98	813	406	406	53.98	813	508	406	79.38	1,270	406	660	79.38
9.525	457	254	203	53.98	813	406	406	53.98	813	508	406	79.38	1,270	406	660	79.38

In making racks for the above reels allow a 4-in. or 102-mm. greater width than the traverse specified below

2N1—Specifications for Ingot Aluminum

GENERAL.—The general specifications 1G1 shall form, according to their applicability, a part of these specifications.

MATERIAL.—2 (a) Three grades of ingot aluminum are recognized

		Per cent
Standard No 1 aluminum	not less than	99.0
Standard No. 2 aluminum		98.0
Special aluminum		99.5

Analysis—(b) One sample ingot of each heat shall be taken for analysis, and in any case not less than one sample ingot from each 500 lb (226.8 kg.) of metal.

(c) Samples shall be obtained by drilling completely through the ingot or half through from top to bottom The weight of the samples obtained by drilling the ingot or ingots should not be less than 120 grams

MANUFACTURE.—3 No scrap shall be used except such as shall accumulate at the manufacturer's plant from material of the same composition and of their own make

3S14—Specifications for 7 x 7 Flexible Steel-Wire Cable

GENERAL.—1 (a) This specification covers the finish material and construction of high-strength steel wire cable composed of steel wires twisted concentrically around a steel wire center thus forming a strand and such strands twisted concentrically around a central strand of the same construction forming a cable

(b) The general specifications 1G1, shall form, according to their applicability, a part of these specifications.

MATERIAL.—2. The wire shall be manufactured of either I. A. S. B. standard steel No 1065, No 1070, or No 1080, the compositions of which are listed below

MANUFACTURE.—3 (a) The steel wires composing the individual strands of the cable shall be laid concentrically around the center wire in one layer of six wires with a left hand (counter-clockwise) pitch or lay The cable itself shall be constructed by twisting six of these strands composed of seven wires each around a seventh strand of the same construction and material with a right hand (clockwise) pitch and with a length of lay of six to eight times the diameter of the whole

(b) The steel from which the wires composing the cable are drawn shall be manufactured by the acid open hearth process.

(c) Wires composing the cable shall be uniformly coated with pure tin to solder readily

(d) Joints in wires in cable having a diameter of 0.156 ($\frac{5}{32}$) inch (3.969 mm.) and larger shall be brazed in a gas fire In cable having a diameter of 0.125 ($\frac{1}{8}$) inch (3.175 mm.) or less wires may be joined either by brazing or twisting, at the manufacturer's convenience. Tucked-in or welded joints are not permitted. No two joints in individual wires shall be closer to one another in the completed cable than 30 ft. (9.14 m.) All brazed joints shall be tinned Exposed brass at joints shall not constitute cause for rejection

WORKMANSHIP AND FINISH.—4 Each length of cable is to be evenly laid and free from kinks loose wires, or other irregularities The cable shall remain in this condition when unwound from the reel or bent around a standard thimble, proper precautions being taken to secure the ends.

PHYSICAL PROPERTIES AND TESTS.—*Tensile test*—5 (a) A tensile test shall be made upon each individual reel of cable purchased of a size.

(b) Samples of cable for testing for tensile strength shall be no less than 24 in. (610 mm.) in length In making tests the distance between jaws of testing machine with sample in place and before test shall be not less than 10 in. (254 mm.)

(c) Samples for tensile test may be clamped in the jaws of the testing machine in the usual manner to facilitate testing, but in case of failure or dispute on individual tests and at the request of the manufacturer check tests shall be made by socketing the samples with pure zinc

(d) Cable for use in the construction of aircraft shall meet the required breaking strength specified in the table.

REELS FOR CABLE
ENGLISH UNITS.

	1,000 feet: Diameter of head	Traverse or distance between heads	Diameter of bundle	Diameter of arbor hole	3,000 feet: Diameter of head	Traverse or distance between heads	Diameter of bundle	Diameter of arbor hole	5,000 feet: Diameter of head	Traverse or distance between heads	Diameter of bundle	Diameter of arbor hole	10,000 feet: Diameter of head	Traverse or distance between heads	Diameter of bundle	Diameter of arbor hole
Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
$\frac{1}{32}$	12	4	8	$1\frac{1}{8}$	12	4	8	$1\frac{1}{8}$	12	4	8	$1\frac{1}{8}$	16	4	10	$1\frac{1}{8}$
$\frac{1}{16}$	12	4	8	$1\frac{1}{8}$	12	4	8	$1\frac{1}{8}$	16	4	10	$1\frac{1}{8}$	16	7	12	$1\frac{1}{8}$
$\frac{5}{64}$	12	4	8	$1\frac{1}{8}$	16	4	10	$1\frac{1}{8}$	16	7	12	$1\frac{1}{8}$	16	10	8	$1\frac{1}{8}$
$\frac{3}{32}$	12	4	8	$1\frac{1}{8}$	16	4	10	$1\frac{1}{8}$	16	7	12	$1\frac{1}{8}$	16	10	8	$1\frac{1}{8}$
$\frac{7}{64}$	16	4	10	$1\frac{1}{8}$	16	7	12	$1\frac{1}{8}$	16	10	8	$1\frac{1}{8}$	18	10	8	$1\frac{1}{8}$
$\frac{1}{8}$	16	4	10	$1\frac{1}{8}$	16	7	12	$1\frac{1}{8}$	16	10	8	$1\frac{1}{8}$	24	10	10	$1\frac{1}{8}$
$\frac{9}{64}$	16	7	12	$1\frac{1}{8}$	16	10	8	$1\frac{1}{8}$	24	10	10	$1\frac{1}{8}$	24	16	10	$2\frac{1}{8}$
$\frac{5}{32}$	16	7	12	$1\frac{1}{8}$	16	10	8	$1\frac{1}{8}$	24	10	10	$1\frac{1}{8}$	24	16	10	$2\frac{1}{8}$
$\frac{3}{16}$	18	7	12	$2\frac{1}{8}$	18	10	8	$2\frac{1}{8}$	24	10	10	$2\frac{1}{8}$	24	16	10	$2\frac{1}{8}$
$\frac{7}{32}$	18	7	12	$2\frac{1}{8}$	18	10	8	$2\frac{1}{8}$	24	10	10	$2\frac{1}{8}$	32	16	16	$3\frac{1}{8}$
$\frac{1}{4}$	18	10	10	$2\frac{1}{8}$	24	10	10	$2\frac{1}{8}$	32	18	16	$2\frac{1}{8}$	36	22	18	$3\frac{1}{8}$
$\frac{5}{16}$	18	10	10	$2\frac{1}{8}$	24	10	10	$2\frac{1}{8}$	32	18	16	$2\frac{1}{8}$	36	22	18	$3\frac{1}{8}$
$\frac{11}{32}$	18	10	8	$2\frac{1}{8}$	32	16	16	$2\frac{1}{8}$	32	20	16	$3\frac{1}{8}$	50	16	26	$3\frac{1}{8}$
$\frac{3}{8}$	18	10	8	$2\frac{1}{8}$	32	16	16	$2\frac{1}{8}$	32	20	16	$3\frac{1}{8}$	50	16	26	$3\frac{1}{8}$

Bend Test.—(e) One bend test is to be made on a sample cut from each reel of cable of a given size. Each sample must be bent once around its own diameter and straightened again at least 20 times in succession in the same direction of bending without any of the wires breaking.

Torsion Test.—(f) A torsion test is to be made on one wire from each sample of cable for tensile test. The wire is to be gripped by two vises 8 in. (203 mm.) apart. One vise shall be turned uniformly at as high a rate of speed as possible without perceptibly heating the wire. One vise shall have free axial movement in either direction.

(g) The number of complete turns which the wire shall stand is determined by the formula

$$\text{Number of turns} = \frac{2.2}{\text{diameter in inches}}$$

$$\frac{55.8}{\text{diameter in millimeters.}}$$

(h) Failure of one piece of wire to show full number of turns specified in the above torsion test shall not be considered cause for rejection, but in such case two additional tests shall be made on two more wires from the same sample of cable, and if both samples meet the requirements of the specifications the cable shall be accepted in this respect.

DIMENSIONS AND TOLERANCES.—6. There shall be no permissible variation in gage below size. Cable having a diameter of 1/16 to 3/32 in. (1.59 to 2.38 mm.), inclusive, shall have a permissible variation of 12 per cent above size, cable having a diameter of 1/8 to 3/16 in. (3.18 to 4.76 mm.) inclusive, shall have a permissible variation of 10 per cent above size, and cable having a diameter of 7/32 to 3/8 in. (5.56 to 9.53 mm.), inclusive, shall have a permissible variation of 7 per cent above size.

DELIVERY, PACKING, AND SHIPPING.—7. (a) All cable shall be shipped on reels in lengths as specified on orders.

(b) The dimensions of reels for different lengths and sizes of cable shall conform to the table attached to this specification.

(c) A tinned or galvanized steel seal wire of approved design shall pass around no less than three convolutions of the cable on the reel and shall pass through a Brass tag showing the name of the manufacturer, the size and length of cable on the reel, the order number or other distinguishing marks, and a record of the test for tensile strength. A lead seal impressed with the official stamp of the representative of the Government making the inspection shall secure the ends of this seal wire and furnish evidence of inspection and acceptance.

(d) The outer layer of cable on a reel ready for shipment shall be protected from mechanical injury in handling and transportation by an efficient covering of burlap.

CHEMICAL COMPOSITION OF STANDARD CARBON STEELS.

Number	Carbon	Manganese	Phosphorus, maximum	Sulphur, maximum
1065	0.60-0.70	0.50-0.70	0.040	0.045
1070	.65-.75	.60-.70	.040	.045
1080	.75-.90	.25-.50	.040	.045

TABLE OF WEIGHTS, SIZES, AND STRENGTHS OF CABLE.

English Units.			Metric Units.		
Diameter, inch.	Minimum breaking strength, pounds.	Approximate weight, pounds per 100 feet.	Diameter, millimeters.	Minimum breaking strength, kilograms.	Approximate weight, kilograms per 100 meters.
0.312 (5/16)	9,200	16.70	7.938	4,173	24.86
.250 (1/4)	5,800	10.36	6.350	2,631	15.42
.218 (7/32)	4,600	8.30	5.556	2,087	12.35
.187 (3/16)	3,200	5.80	4.763	1,451	8.63
.156 (5/32)	2,600	4.07	3.969	1,179	6.05
.125 (1/8)	1,350	2.45	3.175	612	3.65
.094 (3/32)	920	1.45	2.381	417	2.14
.078 (5/64)	550	.83	1.984	248	1.26
.062 (1/16)	480	.81	1.588	218	1.21

REELS FOR CABLE

English Units.

Diameter of strand or cable	1,000 feet. Diameter of head	Traverse or distance between heads	Diameter of handle	Diameter of arbor hole	3,000 feet. Diameter of head	Traverse or distance between heads	Diameter of handle	Diameter of arbor hole	5,000 feet. Diameter of head	Traverse or distance between heads	Diameter of handle	Diameter of arbor hole	10,000 feet. Diameter of head	Traverse or distance between heads	Diameter of handle	Diameter of arbor hole
In.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
1/32	12	4	6	1 1/8	12	4	6	1 1/8	12	4	6	1 1/8	16	4	10	1 1/8
1/16	12	4	6	1 1/8	12	4	6	1 1/8	16	4	10	1 1/8	16	7	12	1 1/8
5/64	12	4	6	1 1/8	16	4	10	1 1/8	16	7	12	1 1/8	16	10	8	1 1/8
3/32	12	4	6	1 1/8	16	4	10	1 1/8	16	7	12	1 1/8	16	10	8	1 1/8
7/64	16	4	10	1 1/8	16	7	12	1 1/8	16	10	8	1 1/8	18	10	8	1 1/8
1/8	16	4	10	1 1/8	16	7	12	1 1/8	16	10	8	1 1/8	24	10	10	1 1/8
9/64	16	7	12	1 1/8	16	10	8	1 1/8	24	10	10	1 1/8	24	16	10	2 1/8
5/32	16	7	12	1 1/8	16	10	8	1 1/8	24	10	10	1 1/8	24	16	10	2 1/8
3/16	18	7	12	2 1/8	18	10	8	2 1/8	24	10	10	2 1/8	24	16	10	2 1/8
7/32	18	7	12	2 1/8	18	10	8	2 1/8	24	10	10	2 1/8	32	16	16	3 1/8
1/4	18	10	10	2 1/8	24	10	10	2 1/8	32	18	16	2 1/8	36	22	18	3 1/8
5/16	18	10	10	2 1/8	24	10	10	2 1/8	32	18	16	2 1/8	36	22	18	3 1/8
11/32	18	10	8	2 1/8	32	16	16	2 1/8	32	16	16	3 1/8	50	16	22	3 1/8
3/8	18	10	8	2 1/8	32	16	16	2 1/8	32	16	16	3 1/8	50	16	22	3 1/8

Metric Units.

Diameter	305 meters. Diameter of head	Traverse	Diameter of handle	Diameter of arbor hole	914 meters. Diameter of head	Traverse	Diameter of handle	Diameter of arbor hole	1,524 meters. Diameter of head	Traverse	Diameter of handle	Diameter of arbor hole	3,048 meters. Diameter of head	Traverse	Diameter of handle	Diameter of arbor hole
mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
0.794	305	102	152	28.58	305	102	152	28.58	305	102	152	28.58	406	102	254	28.58
1.588	305	102	152	28.58	305	102	152	28.58	406	102	254	28.58	406	178	305	28.58
1.984	305	102	152	28.58	406	102	254	28.58	406	178	305	28.58	406	254	203	28.58
2.381	305	102	152	28.58	406	102	254	28.58	406	178	305	28.58	406	254	203	28.58
2.778	406	102	254	28.58	406	178	305	28.58	406	254	203	28.58	457	254	203	28.58
3.175	406	102	254	28.58	406	178	305	28.58	406	254	203	28.58	610	254	254	28.58
3.572	406	178	305	28.58	406	254	203	28.58	610	254	254	28.58	610	406	254	53.98
3.969	406	178	305	28.58	406	254	203	28.58	610	254	254	28.58	610	406	254	53.98
4.763	457	178	305	53.98	457	254	203	53.98	610	254	254	53.98	610	406	254	53.98
5.556	457	178	305	53.98	457	254	203	53.98	610	254	254	53.98	813	406	406	79.38
6.350	457	254	254	53.98	610	254	254	53.98	813	457	406	53.98	914	560	457	79.38
7.938	457	254	254	53.98	610	254	254	53.98	813	457	406	53.98	914	560	457	79.38
8.731	457	254	203	53.98	813	406	406	53.98	813	406	406	79.38	1,270	406	560	79.38
9.525	457	254	203	53.98	813	406	406	53.98	813	406	406	79.38	1,270	406	560	79.38

In making racks for the above reels allow a 4-in. or 102-mm greater width than the traverse specified above.

3N12—Specifications for Sheet Aluminum

GENERAL.—1. The general specifications, 1G1, shall form, according to their applicability, a part of these specifications.

MATERIAL.—2. (a) Two grades are recognized:

	Per cent
Standard No. 1, aluminum	not less than 99.00
Standard No. 2, aluminum	not less than 98.00

Analysis.—(b) Samples for analysis shall be obtained from a random sheet representing each 500 lb. (226.8 kg.) of aluminum, or any lot weighing less than 500 lb. (226.8 kg.) as agreed upon between the seller and the purchaser.

MANUFACTURE.—3. No scrap shall be used except such as shall accumulate at the manufacturer's plant from material of the same composition and of their manufacture.

WORKMANSHIP AND FINISH.—4. All sheets shall be sound (?), free from buckles, seams, discoloration, or other surface defects.

PHYSICAL PROPERTIES AND TESTS.—*Tensile test*—5. (a)

Grade.	Minimum tensile strength.	Minimum elongation in 2 inches (50.8 mm.)
Soft-annealed	12,000 pounds per square inch (8.44 kg./mm.²)	20 per cent.
Half-hard	18,000 pounds per square inch (12.65 kg./mm.²)	15 per cent.
Hard-rolled	22,000 pounds per square inch (15.47 kg./mm.²)	2 per cent.

Bend test.—(b) Soft and half hard sheets shall withstand being bent double in any direction over a pin having a radius equal to the thickness of the sheet without cracking.

SELECTION OF TEST SPECIMENS.—6. Test pieces shall be cut from random sheets representing each 500 lb. (226.8 kg.) of aluminum or any lot weighing less than 500 lb. (226.8 kg.) as agreed upon between the seller and the purchaser. Test pieces may be used for purposes of analysis as under paragraph 2 (b).

DIMENSIONS AND TOLERANCES.—7. Tolerances on all sheets shall be as follows:

Thickness American Wire Gage (B. & S.)	Tolerances Inch	Tolerances Millimeter
10–11	0.003	0.08
12–14	.003	.08
15–17	.0025	.06
18–20	.002	.05
21–23	.002	.05
24–26	.002	.05

Digest of the Foreign Aeronautical Press

Aeronautics (London), September 26, 1917

Aircraft Industrial Research Association Formed.—The Society of British Aircraft Constructors decided to form a Research Association for the aeronautical industry in accordance with a recommendation made by the Department of Scientific and Industrial Research. That recommendation provides for the formation by industries of associations devoted entirely to technical and scientific research work capable of benefiting the industry. These recognized Research Associations must both in their constitution and Board of Management be approved by the Government. In the first five years of their life they are entitled, if necessary, to receive a subsidy from the Government up to an amount not exceeding pound per pound of the funds subscribed by the industry itself, for which purpose a sum of one million pounds has been allocated to the department in question.

If a time period has been imposed for the grant of the subsidies, this is no doubt owing to the reasonable view that, as the beneficial results accruing to the industry directly or indirectly owing to an organized program of research work, become apparent, that industry will be only too anxious to continue to finance its Research Association, and will come to look upon funds so subscribed as a profitable financial investment. It is in order to emphasize this view of the matter that the Government has agreed that contributions by firms to the funds of their industrial Research Association shall be allowed as a deduction for income tax and excess profit duty purposes.

A draft memorandum of association for such research associations has been prepared by the Department of Scientific and Industrial Research. This memorandum provides that the objects for which the Research Association is established are

(a) To promote research and establish laboratories
(b) To accept grants of Government money, etc.
(c) To employ technical advisers
(d) To establish museums, libraries, etc.
(e) To investigate inventions, etc., for the purpose of the industry.
(f) To cooperate with other associations.

What useful purpose, it may be asked, can this Research Association serve beyond that already fulfilled by the aeronautical branch of the National Physical Laboratory which, be it noted, is now also controlled by the Department of Scientific and Industrial Research? The answer can be given with confidence.

In the first place, the work of the N. P. L., valuable beyond all praise, has been purely scientific and in no sense industrial. In one sense, indeed, it has been too scientific, for it has been concerned over much with the minutiae of scientific accuracy to the neglect of wider problems. It has tended rather to hunt down possible margins of errors to one per cent, with the utmost painstaking care where five per cent was adequate for commercial purposes. But the aircraft industry has for it no existence. And if we built solely on N. P. L. data we should no doubt obtain a machine on the verge of theoretical perfection, but it is certain that from a commercial and industrial point of view it would be impossible. Industrial research in the wider sense, therefore, constitutes the first item in the program of the new association.

In the second place there is no gainsaying the fact that the N. P. L. is regarded by private manufacturers and designers or inventors with a certain amount of suspicion. In the matter of the aircraft design it is difficult, if not impossible, to establish proprietary rights in a design or method of manufacture. Consequently the designer of a happy combination of factors, who presented his design for test to this Government institution, had no guaranty that it would not be promptly annexed by the Government without formality or by your leave. In the case of the Research Association controlled by the industry that danger is removed. At best, proprietary rights can be strictly reserved to the designer; at worst, they would go to benefit the whole industry.

Aeronautics (London), October 3, 1917

British Air Supremacy as Illustrated by German Figures.—An official communique is a two-edged sword—it cuts both ways. The German claims of air victories are usually overstated. But let us take them at their face value. Captain Von Richthofen, leader of the famous "circus," also known as Richthofen the First, is reputed to have brought down sixty airplanes, Lieutenant Werner Voss is placed second in the list with thirty-eight opponents to his credit, next comes Lieutenant Wolff with thirty-three, and further down Lieutenant Richthofen "Secundus" with twenty-four. Now the last three have been killed within the last few weeks, and the first seriously wounded, is definitely out of action. So that, if the German claims are correct, we and our Allies have won a considerable success.

Far be it from us to despise the German aerial effort. Frankly, it is superb. The organization of the German Air Service is excellent; its mechanical resources are plentiful, its men—those of the "old gang" that are left to them—are fine and resourceful fighters. Throughout, they are far more methodical than our men. Nevertheless, we shall beat them, but only with a mighty effort. And a change from khaki to navy-blue or grey won't do the trick. Above all, we require organization in our men, and especially material. The more so because the German resources are dwindling fast in the air as upon land. Hitherto recruits for the Air Service have been selected with extreme care, but recently an order has gone forth that all requests for transfer to the Flying Corps are to be accepted irrespective of personal qualifications. In particular, cavalry officers are urged to join the Air Service.

The fighting scout mainly used by the Germans at present is the type D3 Albatros, engined with 170 hp. Benz. Her best flying speed is in the region of 125 miles an hour, her climb 20,000 ft. in 22 minutes. A 200 hp. Benz-Albatros is on the stocks, and will shortly make its appearance.

Meanwhile, it appears from a reliable French source that all is not well with the twin-engined Gotha. Its performance is certainly good—a ceiling of 20,000 ft. with fuel for five hours and getting on for half ton bombs—but the landing speed is most indifferent (as might have been expected) and is stated to be the cause of numerous accidents.

Aeronautics (London) October 10, 1917

The Policy of Reprisals.—On Oct. 4, at a luncheon tendered to him by the Association of Chambers of Commerce, General Smuts lined out the British Government's newly adopted policy toward air reprisals as follows: Our air policy has been entirely different from that of the enemy. It has been our main and constant object to obtain and maintain military predominance in the air on our various fronts and to bomb only military objectives such as railways and railway stations and junctions, aerodromes, docks, depots and military and naval bases of all sorts. Since July 31 we have been fighting a great battle in Flanders, which has meant a great and simultaneous struggle in the air. In the Battle of the Somme we mastered the enemy completely in the air. Taught by this, he has made great efforts to prevent us doing this again, and has concentrated a great many airplanes against us from other fronts. We started bombing with heavier than air machines. The enemy has followed us, but has not caught up. He bombs the French towns and the troops behind the lines, and does far more damage there and inflicts far heavier loss than we have suffered in England, but again we bomb him much more and cause him far greater loss behind his lines.

Last month our naval and military airplanes dropped 207 tons of bombs behind the enemy's lines. In the same period he dropped four and one half tons of bombs on London. In that month we bombed him on twenty-three days and nineteen nights, chiefly attacking his aerodromes, and in particular the great aerodromes at St. Denis, Westrem and Gontrode, where the Gothas live, setting hangars and sheds on fire, and as photographs prove, damaging his machines and pitting his aerodromes with shell holes. We also bombed his billets, trains, transports and railway stations, causing him very heavy losses. In London during last month our total air losses were fifty-one killed and 247 injured. During the first nine months of this year the losses from air raids were 191 killed and 749 wounded, as against 487 persons killed and 14,104 injured in traffic accidents in the Metropolitan Police area.

Hitherto we have as far as possible avoided using the airplane as an engine of destruction and terrorism against the

civilian population of the enemy countries The enemy, on the contrary, has from the very beginning devoted his aircraft to all kinds of non-military uses First with the Zeppelins, and now with airplane, he is conducting a campaign of ruthless, pitiless terrorism against undefended towns and populous centers which have no direct military value Indeed one can but come to the conclusion that the Germans in their raids are avoiding objectives of direct military value Invariably they attack the residential districts of London, not its outside arsenals or fortifications or even its docks, still less places of direct military importance, except very occasionally, and as it were by mistake I imagine their object in all this calculated brutality has been twofold first to strike terror into the hearts of the civilian population, and to destroy their morale by every means, however abominable, secondly to force us to take machines back from the front to the defense of London and other home areas.

In both objects they have miserably failed There is not in London or in the country a single machine taken back from the front for home defense, and the national temper so far from weakening is, on the contrary, hardening under the strain of these terrors and abominations Meanwhile a very bitter temper is growing up in this country, a temper with which any Government will have to reckon seriously in settling its future air policy And I am sure it is not the people of this country who will be to blame for any further intensification of the horrors of war It is a mistake to think that hitherto we have not had any means at all of carrying our aerial warfare into the enemy country But we felt that we should rather prepare for an air offensive on a large scale and we were anxious also to avoid adding further horrors to this war, already the most cruel in the history of the world But we are dealing with an enemy whose Kultur has not carried him beyond the rudiments of the Mosaic Law, and to whom you can only apply the maxim of "an eye for an eye and a tooth for a tooth" On that principle we are now most reluctantly forced to apply to him the bombing policy which he has applied to us, and I am afraid the Government has no longer any choice in the matter

Flying (London), October 17, 1917

The New Gothas.—The bombardier airplanes, which the enemy has recently sent against the British Isles appear to be foolhu machines of a new type They are said to be equipped with four Mercedes engines of 260 hp each and carry fuel for 10 hr Their crew is made up of five men, two pilots, two gunners and a captain, who controls the radio apparatus

The Aeroplane (London) October 3, 1917

The Sopwith Triplane.—In the August issue of the *Deutsche Luftfahrer Zeitschrift*, Robert Eisenlohr, a well-known aeronautical writer, describes the British Sopwith triplane as follows

Among the new machines which the war has created, the Sopwith triplane holds a special position, since it is the first triplane to be employed for practical purposes This type had become obsolete since the little successful experiments of Hans Grade in Germany, of A. V. Roe in England and of Goupy in France However, after Curtiss produced, in 1916, a triplane, Sopwith too turned toward this type of machine

The principal advantage claimed for the triplane is the small span, which can be given on account of the additional lifting area furnished by the third plane, whereas the increased head resistance is neutralized by the use of simplified struts and wiring The lighter loading of the planes also permits use of lighter spars and a comparatively wide or chord

The triplane arrangement may also afford the pilot a better range of vision, as the middle plane is level with his head, and the small chord of the upper and lower planes hides less than the larger wings of a biplane

The Sopwith triplane has a small dihedral, but no retreat is embodied in the wings The planes are staggered and all carry ailerons The body is of rectangular section and carries in front a 130 hp Clerget rotary engine which is housed in a cowl overhanging the body

This machine is produced both as a single seater and as a two-seater In both models a fixed machine gun is carried in front of the pilot but on the two seater machine the observer, who sits behind the pilot, is provided with another machine gun which is mounted on barbette

CHARACTERISTICS

Span all three planes	[illegible]
Chord all three planes	[illegible]
Gap upper and lower	[illegible]
Overall length	[illegible]
Overall height	[illegible]
Span of elevator	[illegible]
Surface area planes	[illegible]
Weight fully loaded	[illegible]

A Novel Propeller.—A novel type of propeller has recently been introduced by Mr Bomke which is grooved to prevent slip

For this purpose the blades of the airscrew are provided on both faces with transverse ribs, the intervening space being shaped in the form of concave grooves The latter are not, however, carried through the whole width of the blade but stop not far from the leading edge The inventor claims that in rotating, the rarefaction of the air within the grooves creates on the forward face of the blade a suction effect which increases the tractive effect On the other face of the blade similar grooves discharge the air in the direction of the trailing edge of the blade thus increasing the rearward thrust

España Automovil (Madrid), September 30, 1917

Spain Creates Naval Flying Corps.—A royal decree issued on Sept 20 creates a Naval Flying Corps which will be directly attached to the Ministry of Marine A naval flying school will be established at Cartagena and a Government factory is to be organized for the production of naval aircraft. As soon as the circumstances will allow four air stations will be created at the principal naval bases at Cadiz, Ferrol and Cartagena, and later on at the second class bases of Galicia and Mahon (Balearics)

THE ZEPPELIN L-49, WHICH WAS CAPTURED INTACT IN FRANCE
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News of the Fortnight

American Flying Records Broken

A remarkable flight from Chicago to San Antonio, Tex, was completed by an L W F biplane at 10 a m, Nov 13, during which several American records for speed and distance were shattered

An L W F machine, piloted by H W. Blakley, left Chicago on Sunday, Nov 11 in a driving rainstorm Blakley flew from Chicago to Muskogee, Okla, about 650 miles, at an average speed of 120 miles per hour The distance, from Muskogee to Dallas, Tex, was made at an average speed of 130 miles per hour

The great bursts of speed of the L W F machine were made with the eight cylinder 210 hp aluminum engine manufactured by the B F Sturtevant Co of Hyde Park, Boston, Mass Detailed reports of the performance of the engine during the flight are not yet available, but the flight indicates that another American engine of great power, speed and endurance has been successfully developed and tried out

The L W F machine used in the flight was one of the standard models produced by the L W F Engineering Co

All-American Fighting Airplane Tested

The first fighting airplane, wholly made in America of American materials, has taken the air in successful test flights In making the fact known officials of the Aircraft Production Board said few changes in the design of either the plane or the Liberty Engine were believed necessary, and that production in quantity of the fighting machines soon would be in progress in many factories

By the first of the new year it is expected that the aircraft program will be well under way, and by July 1 the Government expects to be able to supply any demands of its Allies Machines, which United States forces in Europe will need when Spring comes, are being built abroad

American engineers expect that the aircraft program can be made whatever the Allies require Originally the figures were set at 50 000 engines and 22,000 planes by July 1

Council of National Defense Moves

The temporary office building now occupied by the Council of National Defense, its advisory commission, and the subordinate committees of both bodies, including the War Industries Board at Seventeenth and F Streets Washington, D C contains slightly in excess of 100,000 sq ft of space with heating, toilet and fire-protection facilities customary in office buildings

The construction required over a million board feet of lumber and the maximum labor employed was 430 workmen and mechanics of all classes The cost of the completed structure will be under $225,000

The new building will house upward of 600 persons in the personnel of the Council and its subordinate bodies Aside from this office space has been given to the representatives of the purchasing commissions of the Allied Governments

Election of Aero Club of America

At the annual meeting of the Aero Club of America, held at the club house, 297 Madison Avenue, New York, on Nov 12, the following officers were elected Alan R Hawley, president, Henry A Wise Wood, first vice-president, Godfrey L Cabot, second vice-president, Rear Admiral Bradley A. Fiske, U S N, third vice-president, and Jerome Edwards, fourth vice-president Governors—Class A—term expiring 1921, Cortland F Bishop, Alan R Hawley, James E Miller and Henry A Wise Wood, term expiring 1918, Rear Admiral Fiske Governors—Class B—Albert B Lambert, Henry B Joy, Godfrey L. Cabot, George M Myers, John Hays Hammond, Jr, Alberto Santos-Dumont, Brigadier General Robert K Evans, U S A, Max C Fleischmann, treasurer and Charles E Warren.

Italian Makes a Fast Flight

Lieut Giuseppe Adamoli of the Italian Royal Flying Corps set a new record for long distance speed flying on Nov 1, when he traveled from Langley Field, Norfolk, Va, to Hazelhurst Field, Mineola, N Y, a distance of 336 miles, in two hours and twenty-five minutes. Adamoli used a one-seated Macchi seaplane for the flight He left Norfolk at 10 30 o'clock in the morning and reached Mineola at 12.55 o'clock in the afternoon. Adamoli's seaplane carries two machine guns.

Civil Air Services Planned

The Daily Express of London announces that as soon as the war is ended aerial navigation plans which are being drawn up by the Civil Aerial Transport Committee, appointed by the British Government will be put in operation step by step, and the ends of the world will be brought together by long-distance airplane service

The *Express* says it has information that if favorable weather conditions prevail it is likely that the Atlantic will be crossed by an airplane before the end of this year It understands that the flight will be made by way of the Azores, so that the journey may be broken

The bridging of the Atlantic by airplane, it says, will be only the beginning Plans are being laid for regular air service, not only to America, but to India, South Africa, and Australia If they are carried out Melbourne will be brought within eight and one-half days of London; India, three days, and Cape Town, four or five days. The bee line to Cape Town would of course cross the Sahara, but the winds of the desert raised obstacles to the route, and the route chosen is by way of Malta, Cairo, Khartoum and Victoria Falls

The *Express* says that the machines, which will be used for these world journeys will be of the type developed by Handley Page, will travel 200 miles an hour, will have multiple engines to avoid the necessity for descending if one engine gives out, will carry four or five passengers, and will be able to cover about 3,000 miles in 15 hours. Two pilots will take turns at the wheel There will be comfortable inclosed quarters and the journey will not be more exhausting than a railway trip of similar duration

Liberty Engine Reported Satisfactory

It is said that influences have been at work in an organized effort to belittle the qualities of the Liberty engine and to create in the minds of the public the impression that a foreign engine would be adopted in its place.

Government officials declare that the Liberty engine has stood successfully every test that has been applied to it, including actual use in airplanes, and its performances have left nothing to be desired

A number of contracts for the manufacture of the Liberty engine have been let and the work is progressing so satisfactorily the first deliveries will be about Dec 1 The number that will be available at that time is withheld for reasons of public policy, but assurance is given that it will be sufficient to meet the immediate needs of the aircraft program and that the output will increase with each month

The program of the Aircraft Production Board has involved the expansion of many factories heretofore engaged in the manufacture of automobiles, as well as the increase in size and number of factories making aircraft alone This expansion has attracted thousands of workmen to the localities of these plants, and the resulting increase in population has made the housing of the men and their families one of extreme difficulty

Maj. Gen. Biddle, Assistant Chief of Staff

The Secretary of War authorizes announcement of the appointment of Maj. Gen John Biddle, formerly president of the War College, as Assistant Chief of Staff to fill the vacancy caused by the appointment of Gen. Tasker H. Bliss as Chief of Staff

Major General Biddle is a native of Michigan and was born Feb 2, 1859 He was appointed from that state to the Military Academy Sept. 1, 1877, and graduated with the class of '81 He returned to the academy as superintendent in 1916 and served approximately a year in that capacity He was appointed a brigadier general and assigned to the line a few months ago

Restrict Ball-Bearing Trade

The American consul general at London has cabled as follows:

Minister of Munitions from Nov. 1 forbids the manufacture, sale, and delivery of ball bearings or roller bearings or any part thereof except under license Applications should be addressed to the Director of Ball Bearings, Ministry of Munitions.

Census of the Army

Under the direction of the Committee on Classification of Personnel in the Army, headed by Prof. Walter Dill Scott, the War Department is taking a census of the selected men as they arrive at the training camps. This army directory writes practically a life history of every man selected for service. It shows his education, business experience, the amount of salary received in civil life, proficiency in any trade, aptitude for special work in The Army, ability to speak foreign languages, and even a statement of the soldier's ability to fit into diversions and entertainment.

Secretary Baker makes the following comment on the desire of the selected man to get into the thick of action:

"In those camps, each man is asked: 'What do you want to do?' I have had reports from five or six of the largest camps, and they show that the majority answered in effect: 'I don't care what I do just so I get to France among the first!' The next question asked them is: 'What branch of the service do you prefer?'

"Now, one who didn't know America would expect them to say: 'Well, I have been working in a store', 'I have been a hand on a farm', 'I have been a mechanic', 'I have been a clerk', 'I don't know much about guns and cannon, perhaps some of the non-combatant places is the place where I can render the best service.' But what is the fact? These sons and brothers, drawn out of life by selection—more than one third have asked to go into the infantry service. The next choice is the light artillery, the next is the heavy artillery service; the next is the aviation service. So that what they asked for in a tremendously predominating majority of instances is, not the non-combatant service, for which their previous experience might well qualify them, but the fighting branch, so that they can take the risk of fighting for their country with the real weapons of war! The boys at the front and getting ready to go are all right! Our nation need have nothing but mounting pride at the spectacle they present."

The committee has put into operation a comprehensive plan for classifying the men as they undergo training. Each company commander becomes practically a census taker. He distributes question cards among his men. The buff copy of this card is preserved with the company records after it has been filled out. The white original is sent to division headquarters where a division personnel officer studies the answers given and classifies the selected man according to his capabilities.

One day's examinations at Camp Upton for "preference as to branch of service," showed: Infantry, 722; cavalry, 6; field and heavy artillery, 427; coast artillery, 52; engineers, 183; signal corps and aviation, 123; medical corps, 53; quartermaster corps, 561; ordnance, 17; machine guns, 7; trains, 4; veterinary service, 1.

General Henderson Praises U. S. Aircraft Program

Maj.-Gen. Sir David Henderson, who is retiring as head of the British Air Board to undertake an important "special duty," in an interview with the Associated Press, praised the American war program, but warned against the danger of overdoing standardization in aircraft. He expressed the belief that the American public should be prepared for "fairly severe" losses in air training.

"I shall not say much to you about the plans of the British air service for the immediate future," Sir David said. "That would be giving information that the enemy is very anxious to obtain. The Germans are acutely alarmed over the preparations that the Entente Allies are making for the air war next year. They are under no illusions about it and they are bending every effort to counter it by a stupendous program on their own side. But we have had the upper hand of them in the air from the very beginning, and feel sure, especially with the help of the United States, that our mastery will grow stronger notwithstanding all their efforts.

"The British Flying Corps is from seventy to a hundred times larger today than at the start of the war, and we have made this tremendous augmentation at the same time that we have been carrying on a war that involved heavy losses and continual replacements from the very first day.

"As to the production of a standard type airplane, there still is some difference of opinion. Certainly there is great danger in overstandardization. If you want the best type you must be continually improving and changing. The question the air commander must ask is 'How long can you afford to go on with a particular type of machine?' and 'Whether it is likely soon to be superseded by a better type?'"

Germany Preparing to Raid America

Dr. Lyman B. Powell, president of Hobart College, who has returned from the war zone, where he had unusual opportunities to observe conditions, is quoted as saying that the Germans are planning to raid the American coast with their aircraft within the next six months. To accomplish this, he said, they are now engaged in building a fleet of huge airplanes which could travel from 100 to 200 miles an hour, and could rise to a height of 20,000 ft., if necessary.

"It is a mistaken policy," said Dr. Powell, "to suppress or minimize the seriousness of the situation. The American public is not even half awakened to the havoc that has been wrought by the airplanes in England. The casualties are much greater than the people over here have been led to believe. Since May 1, 2,000 men, women and children have been maimed or killed in London by air raids.

"It is just such a peril that we are facing in this country, but we will not realize it. French military experts have informed me that the Germans are building airplanes on such a huge scale that the Allies will have to work ten times as fast as they are to keep up with them. In the first place, they are devoting themselves entirely to the construction of biplanes that will be capable of operating from a height of 20,000 ft.—airplanes, furthermore that will be able to carry at least two tons of bombs.

"The Germans intend to settle this war with the airplane. What is more, they intend to carry the war right to our doors with a fleet of huge seaplanes, which will be able to travel from 100 to 200 miles an hour. It is about time that the people here knew the truth about these things. Thus far the western line and the British fleet have stood between America and the fate of Belgium. But airplanes that can rise to a height of 20,000 ft. and travel from 100 to 200 miles an hour will overcome even those barriers, and America, unless she is awake, unless she is prepared, is from that moment at Germany's mercy."

The Standard Aircraft Corp. Formed

The Standard Aircraft Corp. was granted a charter by the Secretary of State of New York on Oct. 31 with an authorized capitalization of $5,000,000. The offices of the new company is in the Woolworth Building, New York City, and its plant is located at Elizabeth, N. J.

The company is formed for the purpose of manufacturing aircraft and other contrivances and devices for aerial navigation, either from land or water. The stockholders are Harry B. Mingle, Llewellyn Park, West Orange, N. J., Charles H. Day, Plainfield, N. J., and Daniel L. Meehan, Jr., New York City.

President Mingle states that the new corporation will be utilized entirely for production work, while the Standard Aero Corp. will devote its organization and plant to experimental and engineering work.

Rubber Company's Aeronautical Course

The Goodyear Tire & Rubber Co., Akron, Ohio, has added a course of aeronautics to the curriculum of its factory school. Only those who have had a high school course or its equivalent will be permitted to enter the new class. A small tuition fee to cover necessary expenses for experimental equipment and the like will be charged.

The school is the result of a suggestion by Goodyear men, who pointed out that a company so largely engaged in the manufacture of aircraft should devise some method of teaching its own employes the fundamentals of aeronautics.

Cold Light Mfg. Co. Moves

The Cold Light Mfg. Co., Inc., has found it necessary, on account of the large demand for its products in the Eastern States, to move its general offices and studios from Denver, Col., to 558 West One Hundred and Fifty-eighth Street, New York City. Its Western studio will be maintained to supply that territory.

Succeeds Schweizer & West

The West Woodworking Co. has succeeded the Schweizer & West Mfg. Co., 308-324 North Ada St., Chicago, Ill., in the manufacture of Westmore Spitless propellers. Charles L. West is president and manager of the new concern.

Curtiss Experimental Plant Nearly Ready

The new Curtiss experimental plant near Garden City, N. Y., is nearly ready. The main building is 200 by 300 ft. and it is of the reinforced concrete type of construction.


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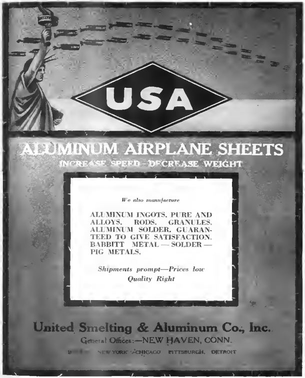
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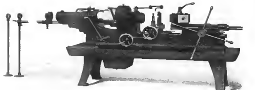

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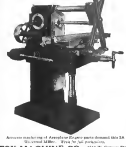

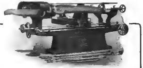

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